Midterm 1 10 October 2019, questions and answers

Introduction to Psychology (York University)

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Important Dates

- 1879 – Psychology founded as a science by Wilhelm Wundt when he established the first psychology research lab in Germany
- 1881 – Wundt creates the first research journal in psychology
- 1890 – William James writes his influential book *Principles of Psychology*
- 1893 – G. Stanley Hall opens the first American psychology research lab
- 1950s – The cognitive revolution begins and cognitive psychology becomes the newest field
- Psychological past before 1879 is rooted in philosophy with the concept of associationism and in early medicine with the concept of localization of function

Important Names

- Sigmund Freud
    - Focused on the unconscious which he believed to contain thoughts, memories, and desires hidden below the surface of consciousness but still able to affect behaviour.
    - Founded psychoanalytic theory which attempts to explain various aspects of behaviour and thinking by focusing on the unconscious mind.
- B.F. Skinner
    - Central figure of behaviouralism and founded the concept of repeat responses and positive outcomes.
    - Believed that behaviour is a result of the environment and not by the individual and that free will was an illusion.
- Donald Hebb
    - Neuroscience – Brain is the key to understanding behaviour
- Brenda Milner
    - Neuroscience – Work with patient HM (Henry Molaison) to study different memory systems, the hippocampus, and brain hemisphere interactions.
- Gustav Fechner
    - Paved the way for psychophysics
- Roger Sperry
    - Split-brain research and localization of function.

Theoretical Perspectives

- Structuralism
    - Founded by Wilhelm Wundt who focused on analyzing consciousness into its basic elements and investigating how all the elements are related.
    - Used introspectionism (examination of one's conscious experience)
- Functionalism
    - Founded by William James who believed that consciousness was not individual elements but instead was a flowing stream.
    - Focused on the purpose and function of consciousness rather than its structure with ties to adaptation and evolution.

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- Psychoanalytic Theory
    - Developed by Sigmund Freud who emphasized the role of the unconscious in behavior and thinking.
    - Psychoanalysis was the first form of psychological treatment and the jumping off point for clinical psychology.
- Behaviourism
    - Developed by John Watson and B.F. Skinner who believed scientific psychology should be solely focused on objective behaviour and not emotions, feelings, goals, etc.
    - Identified that rewards and punishments influence behaviour, attempted to relate responses to stimuli.
- Humanistic Psychology (vs. The Dark Side)
    - Developed by Carl Rogers and Abraham Maslow who believed that Freud's ideas represented the dark ugly side of psychology.
    - Emphasizes the unique qualities of humans such as freedom, potential for growth, and self-realization.
    - Belief that people are not pawns of nature or heritage.
- Current Trends
    - Clinical Psychology – Diagnosis and treatment of psychological disorders.
    - Evolutionary Psychology – Psychological processes are adaptive and heritable.
    - Positive Psychology – Explores the positive side of human behavior (happiness, optimism, etc.)
    - Cultural Psychology – Many psychological processes vary from culture to culture.
    - Neuroscience – Relating the brain (structures and functions) to psychological processes.
    - Cognitive Psychology – Studies information processes, thinking, reasoning, problem solving, etc.
    - Social Psychology – Study of how individuals think and behave in social situations]
    - Health Psychology – Study of how psychological processes can be used to improve health and well-being.
    - Developmental Psychology – Study of how behaviour changes across a lifetime.

Research Approaches

- Naturalistic Observation
    - Involves observing subjects' behaviours in their natural environment systematically while being as unbiased as possible.
    - Allows the study of behaviour under less artificial conditions but the observer's presence may alter the subject's behaviour. It is also difficult to interpret the observations numerically.
- Case Study
    - An in-depth investigation of an individual or group of individuals. Used by clinical psychologists and very good for investigating certain phenomena like mental disorders.
    - Major issue is high subjectivity and bias.

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- Survey Research
    - Use of questionnaires or interviews to gather information on difficult-to-observe behaviours.
    - Useful for collecting data from large sample sizes but is subject to deception and false responses due to self-reporting.
- Correlational Research
    - Looks for association between variables.
    - Measured using correlation coefficients which are values between +1 or -1 which represent the degree of association.
    - Positive values represent positive correlations (both variables increase or decrease together) while negative value represent negative correlations (as one goes up the other goes down) and the closer the value is to 0, the lower the association.
    - Correlation does not always imply causation.
- Experimental Research
    - The controlled manipulation of one variable (independent variable) in order to observe the change in another variable (dependent variable).
    - Other variables that may affect the results are called extraneous variables. A confounding of variables occurs when it is difficult to distinguish between the effects of two closely related variables.
    - Experiments are subjected to experimenter's bias. This can be prevented by using random assignment and a double-blind procedure to ensure an equal and unbiased distribution of participants across all conditions.

Statistics

- Descriptive Statistics
    - Central Tendency
        - Mean – The average;
        - Mode – The value that appears most frequently
        - Mean – The middle value when all values are arranged in numerical order
    - Variability
        - Range – The largest value minus the smallest value.
        - Variance – The average of the squared differences from the mean
        - Standard Deviation – Measure of how spread out the numbers are;
- Inferential Statistics
    - Makes inferences about the whole population by using the data drawn from a subset of the population.
    - In order for inferential stats to be accurate, the sample drawn must be representative of the whole population.
- Validity
    - Internal – Are there any alternative explanations?
    - External – Can the results be applied to the general population?

- Representation of Data
    - Frequency Distribution

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        - An orderly arrangement of scores indicating the frequency of each score or group of scores. Usually in table format.
        - A frequency polygon is a type of line graph used to graphically represent the data of a frequency distribution table.
    - Normal Distribution
        - Symmetrical bell-shaped curve which represents the pattern of distribution of a specific quality, trait, or characteristic across the whole population.

Nervous System Anatomy

- Neurons
    - Building blocks of the nervous system involved in intraneuronal (within neuron) and interneuronal (between neurons) communication.
    - Consists of
        - Soma: Cell body (nucleus, ribosomes, etc.)
        - Dendrites: Branching structures that receive signals.
        - Axon: Structure that sends signals. Contains terminals to release neurotransmitters.
        - Myelin Sheath: Insulating material that protects neurons and allows for transmission of signals.
        - Synapse: The gap between the axon of one neuron and the dendrites of the next neuron.
- Glial Cells
    - Produce cerebrospinal fluid to cushion the brain and spinal cord.
    - Form the blood-brain barrier to protect the brain from foreign material.
    - From the myelin sheaths of neurons by wrapping around them.
    - Have many other support functions for the brain and neurons.
- Peripheral Nervous System
    - Somatic Nervous System
        - Made up of nerve fibres that connect to voluntary muscles and sensory receptors.
        - Afferent fibres carry information inward while efferent fibres carry information outward.
    - Autonomic Nervous System
        - Sympathetic Nervous System
            - Active during stressful situations and emergencies. Mobilizes fight-or-flight response.
        - Parasympathetic Nervous System
            - Active when the body is under normal circumstances and at “rest.”
- Central Nervous System
    - Consists of the brain, where information integration and processing occurs, and spinal cord, which connects the rest of the body to the brain.

Neurotransmitters

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- Agonists vs. Antagonists
    - Agonists are chemicals that mimic the functions of neurotransmitters while antagonists are chemicals that inhibit the functions of neurotransmitters. Nicotine mimics ACh while curare blocks ACh.
- Acetylcholine
    - Neurotransmitter between motor neurons and voluntary muscles. Also associated with memory.
    - Too much ACh can cause muscles spasms and overactivity of muscles while too little can cause complete paralysis and underactivity of muscles.
- Dopamine
    - Released from pleasurable activities. Parkinson's disease results from the degeneration of the dopamine centres of the brain.
- Norepinephrine
    - Synthesized from dopamine and affects several bodily functions. Key in the fight-or-flight response.
- Serotonin
    - Helps to regulate mood, arousal, and sleep. Higher levels of serotonin are linked to better moods and lower aggression levels.
- GABA
    - Inhibitory neurotransmitters involved in the regulation of anxiety. Disturbances to GABA circuits are linked to anxiety disorders and epilepsy.
- Endorphins
    - The body's natural painkillers. Resemble opiates in structure and effects.

Resting and Action Potentials

- Resting Potential
    - A neuron's stable negative charge when the cell is inactive. Maintained by the sodium-potassium pump which pumps out 3 sodium ions for every 2 potassium ions pumped in.
- Action Potential
    - A brief positive shift in a neuron's electrical charge that travels along an axon. When a neuron is stimulated by a neurotransmitter, its electrochemical gradients shift to make the neuron slightly more positive by pumping in more sodium ions. Once this process begins, either the neuron fires or it doesn't.
    - Degrees of stimulation are determined by the rate at which these action potentials occur. The greater the rate, the greater the stimulation. This rate can be increased by increasing the diameter of the axon which is done by myelinating the axon.
    - Following each action potential, there is a refractory period during which another action potential cannot occur and resting potential is restored.

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Synaptic Transmission

- Activation Steps
    - Synthesis: Neurotransmitters are created in the soma of each neuron.
    - Transport and Storage: Neurotransmitters are transported to the axon terminals and stored.
    - Release: Synaptic vesicles containing neurotransmitters fuse with the cell membrane and release their contents into the synapse once the action potential reaches the axon.
    - Binding: The neurotransmitters bind to the postsynaptic neuron and stimulate it.
- Deactivation Steps
    - Deactivation: GABA and other enzymes can destroy or deactivate neurotransmitters.
    - Autoreceptors: Some neurotransmitters can bind to the releasing neuron and cause feedback inhibition.
    - Reuptake: Leftover and excess neurotransmitters can be brought back into the axon terminals to stop their effects.
    - Degradation: Enzymes in the synapse can break down excess neurotransmitters.

Methods of Neural Research

- Examination of the brain after death (e.g. Broca and Wernicke)
- EEG: Electroencephalography monitors electrical activity in the brain
- CT Scans: Computed Tomography combines multiple x-rays taken from different angles to create cross-sectional images of the brain.
- PET Scans: Positron Emission Tomography uses radioactively tagged molecules to examine real time activity of the brain.
- MRI: Magnetic Resonance Imaging uses magnetic fields and radio waves to detect brain tissue.
- fMRI: Functional MRIs measure brain activity by detecting changes in blood flow.

Localization of Function

- Broca's Area
    - Located in the left frontal lobe. Responsible for the muscle movements required in speech production.
- Wernicke's Area
    - Located in the temporal lobe. Responsible for language processing and comprehension.
- Layers of the Brain
    - Hindbrain
        - Lowest part of the brain. Begins at the bottom of the brain stem.
        - Cerebellum – Associated with movement and sense of balance.
        - Medulla – Associated with unconscious functions like breathing.
        - Pons – Associated with sleep and arousal.
    - Midbrain
        - Segment of the brainstem between midbrain and forebrain.
        - Involved in sleep regulation, arousal, and dopamine production.

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    - Forebrain
        - Most sophisticated region.
        - Hypothalamus – Controls ANS, pleasure centre
        - Cerebral Cortex – Highest level of processing and localization of function.
- Lobes of the Brain
    - Occiptal Lobes
        - Primary visual cortex
    - Parietal Lobes
        - Touch
    - Frontal Lobes
        - Executive control (thought organization)
        - Primary motor cortex (top controls legs, bottom controls tongue)
        - Broca's Area
    - Temporal Lobes
        - Primary auditory cortex
        - Wernicke's Area
    - Hippocampus – Associated with memory
    - Amygdala – Associated with emotional control
- Right Brain/Left Brain
    - The left hemisphere of the brain appears to be associated mainly with language while the right hemisphere appears to be associated with visual-spatial processing. What's more is both hemispheres seem to exhibit differing preferences.
    - The evidence for this comes from split-brain research conducted by Roger Sperry.
- Doreen Kimura
    - Men, in general, are more spatial, right hemisphere
    - Women, in general, are more verbal, left hemisphere
        - Largest testicle in most men is on the right
        - Largest breast in most women is on the left

Endocrine System

- Consists of various glands that release hormones into the body. Much of the endocrine system is controlled by the hypothalamus which has intimate connections with the pituitary gland.
- Oxytocin is a hormone which regulates reproductive behaviours, testosterone is a hormone which regulates male growth and development, and cortisol is a hormone which regulates temperature and stress.

Evolutionary Psychology

- Recognizes that a species' behavioural patterns are reflective of solutions to adaptive problems.

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Sensation and Perception

- Sensation is the taking in of information and making contact with the sensory areas of the brain. Perception is the mental operations that organize, process, and integrate sensations into meaningful patterns.

Psychophysics

- The study of how physical stimuli are translated into psychological experiences.
- Thresholds
    - Gustav Fechner was a German scientist who wanted to find the absolute threshold of the senses. The absolute threshold is defined as the minimum stimulus intensity detected 50% of the time.
    - The Just Noticeable Difference (JND) is the smallest difference between two amounts of stimuli detectable.
    - Weber's Law: Size of JND proportional to the size of the initial stimulus. Used to determine sense sensitivity.
- Method of Limits for Absolute Threshold
    - Stimulus intensity is either increased or decreased by a fixed amount from trial to trial and participants report when they are able to perceive or can no longer perceive the stimulus. The threshold is reached when results are 50% accurate.
- Signal-Detection Theory
    - Implies that the observed JND is affected by both decision processes and sensory processes which are affected by things like emotional, perceptional, and situational factors.
- Sensory Adaptation
    - An automatic process that allows people to ignore constant stimuli, such as a repeating noise or smell, and focus on changes around them. The longer you are exposed to a stimulus, the more your sensitivity to it decreases.

The Senses

- Hearing (Audition)
    - The external ear contains the pinna which collects sound and focuses it on the middle ear which contains the ossicles (hammer, anvil, stirrup) which amplifies the sounds. These sounds then go to cochlea in the inner ear which is filled with fluid surrounding the hair-covered basilar membrane.
    - The hair cells are stimulated by the movements in the fluid caused by the soundwaves and transduce this stimulation into neural impulses that get routed through the thalamus to the primary auditory cortex in the temporal lobes.
- Taste
    - Specialized cells in the gustatory system called taste buds sense taste molecules dissolved in saliva. These signals are then transduced and routed through the thalamus to the gustatory cortex.

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- Smell
    - The olfactory membrane in the nasal passage contain olfactory receptors which have tentacle-like protrusions that contain receptor proteins. When these receptors are stimulated and the signals are transduced and sent to the brain through the olfactory nerve.
    - This is the only sensory process that does not involve the thalamus.
- Touch
    - The skin contains nerve ending that respond to different temperatures and pressures. These nerve endings respond to heat, cold, pressure, and pain. Only pressure has its own receptors and different sensations are caused by different combinations of nerve endings activating.
- Vision
    - Light Waves
        - Amplitude corresponds to brightness
        - Wavelength corresponds to colour
        - Purity corresponds to sensation
    - The Eye
        - The eye acts as a camera. The cornea, pupil, and lens focus light onto the retina which transduces the signals via rods and cones.
    - Transduction
        - Rods and cones are photoreceptors that contain photopigments which undergo conformational changes in their chemical structure when they absorb light.
        - Rods
            - Contain Rhodopsin
            - No colour, night vision
            - 120 million
        - Cones
            - Contain Iodopsin
            - Colour, daytime vision
            - 6 million
    - Primary Visual Pathway
        - Rods/Cones -> Bipolar/Ganglion -> Optic Nerve -> Thalamus -> Primary Visual Cortex

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- Colour Vision
    - Trichromatic Theory
        - Developed by Thomas Young and Hermann Von Helmholtz
        - Cone-specialization: Three types of cones specialized in a different hue. Combinations of these cones allows for different colours.
        - However, red-green colour-blind individuals see green afterimages after a red image pops up indicating some kind of relationship.
    - Herring's Opponent Process
        - One cone has blue and yellow, one cone has red and green, one cone has black and white.
    - Current Theory
        - Cone cells follow trichromatic theory while thalamus cells follow the opponent process.
- Vision for Perception and Vision for Action
    - Theory developed by Mel Goodale. Proposed that there are two visual systems.
        - Vision for Perception
            - Seeing and creating an internal representation of the world.
            - Follows ventral stream
        - Vision for Action
            - Guiding your actions to the object represented using sight.
            - Follows dorsal stream

Perception

- Gestalt Laws
    - Figure/Ground
        - Distinguishing focus of image from background
    - Proximity
        - Brain is wired to see things that are closer together as one unit
    - Similarity
        - Brain is wired to see things that are similar to each other as one unit
    - Continuity
        - Points connected by a straight line or curve are seen in ways that follow the smoothest path. Additionally, lines are seen as one unit.
    - Closure
        - Images are grouped together if they seem to complete some entity.
    - Connectedness
        - Elements connected by uniform visual properties are seen as one unit.

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- Depth Perception
    - Binocular Cues
        - Retinal Disparity: Both eyes see different images. The amount of retinal disparity is a distance cue. The greater the distance, the less the disparity.
        - Convergence: Distance cue from muscles. Indicates how much the eyes are turned inward. The more convergence, the shorter the distance.
    - Monocular Cues
        - Relative Size: The smaller an object looks the further away it is.
        - Overlap: The overlapped object is seen as further away than the overlapping object.
        - Linear Perspective: As things go further into the distance, the more they appear to converge.
        - Gradients: More detailed images are closer.
- Illusions
    - The role of expectancy and experience. Our perceptual expectancies can mislead us.
        - Poggendorf Illusion
        - Gestalt Law of Pragnaz – People will interpret ambiguous or complex images in the simplest form possible.
        - Context Effects
    - Perceptual Sets
        - The expectation of a person's perception based on prior experience.

Echolocation: Daniel Kish and Mel Goodale

- Blind echolocation experts make click noises and use the visual cortex to process the clicks and echoes. This demonstrates plasticity.
- Evidence
    - Made recordings of clicks and echoes as the experts stood outside and tried to identify different objects.
    - Played the recordings back in an fMRI. The recordings were perceived by the visual cortex and the auditory cortex was no more activated than without the sounds.
    - When done with non-blind participants, no differences were detected.

Gate-Control Theory

- States that incoming pain sensations must pass through some kind of gate in the spinal cord. The gate is not anatomical or physical but is instead a pattern of neural activity.

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